Partners: AR, AZ, CA, CO, FL, IA, ID, KS, KY, LA, MO, ND, NY, OH, OK, OR, PA, RI, SC, SD, TN, UT, VT, WA, WI and WY state environmental and/or health agencies
Challenge: Support the environmental management and public use of U.S. lakes and reservoirs by providing a capability of detecting and quantifying cyanobacteria harmful algal blooms (HABs) using satellite data records (ongoing)
Resource: Provide satellite derived measures of cyanobacteria, software and training in collaboration with the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Survey (USGS)

"The images we've been receiving through the CyAN project have been tremendously helpful to the Utah Department of Environmental Quality (DEQ) Division of Water Quality (DWQ), providing the foundation for a wide range of useful outputs. It allows Utah DEQ/DWQ to better target field sampling and more efficiently use our limited resources to protect public health. Finally, images are easily shared with response agencies as a useful visual communication aid." – Utah DEQ/DWQ Biological Assessment and HAB Programs Coordinator Benjamin M. Holcomb

Cyanobacteria blooms are an environmental and human health problem across the U.S. They are capable of producing toxins, odors, and surface scum that threaten the health of humans and animals, the quality of drinking water supplies, and the ecosystems in which they develop. Scientists at EPA are part of a team of specialists using remote sensing data to improve cyanobacteria detection methods. Improving the detection process would help state environmental and health agencies better determine whether to post public advisories to protect aquatic and human health.

The Cyanobacteria Assessment Network (CyAN) is a multi-agency project among EPA, NASA, NOAA and USGS to develop an indicator system using historical and current satellite data to quantify the temporal frequency, spatial extent, and magnitude of blooms in U.S. lakes. CyAN is providing weekly cyanobacteria monitoring data to state environmental and health departments from the European Space Agency Sentinel-3 satellite, training opportunities, and software applications.

One of the CyAN tools is an Android mobile application that provides simple access to satellite derived spatial and temporal information on cyanobacteria concentrations. Any state is welcome to participate, and the states currently accessing data include Arizona, Arkansas, California, Colorado, Florida, Idaho, Iowa, Kansas, Kentucky, Louisiana, Missouri, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Washington, Wisconsin and Wyoming. For more information: https://www.epa.gov/water-research/cyanobacteria-assessment-network-cyan

Partner: Environmental Council of the States (ECOS)
Challenge: Need for non-regulatory performance targets for sensors that measure fine particulate matter (PM2.5) and ozone in the U.S. (ongoing)
Resource: "Deliberating Performance Targets for Air Quality Sensors" Workshop and Webinar

"For this EPA ORD hosted workshop, state attendees were able to contribute the state agency perspective to a broad discussion regarding sensor quality, data quantity, and how smaller, lower-cost air monitoring sensors may be used by state agencies. They were also able to gain a sense of how different parties – national and international, private and public – are handling the addition of smaller, lower-cost sensors to the market." – ECOS Senior Project Manager Kelly Poole

Over the past several years, miniaturized, lower-cost air monitoring sensors have entered the market and are now being used by researchers, industrial facilities, state and local government agencies, tribal nations, citizen scientists and the public for a variety of purposes. New applications include a variety of activities, including: real-time high-resolution mapping of air quality at a far greater density than regulatory monitors, real-time public communication of sensor data, fenceline monitoring to detect emissions events, community monitoring to assess hot spots, personal monitoring, and applications to collect data in remote places. Given the rapid adoption and technological advances of new air sensor technologies, there are numerous questions about how well they perform and how lower-cost technologies can be used for certain non-regulatory applications.

EPA, in coordination with ECOS, convened a workshop in June 2018 on "Deliberating Performance Targets for Air Quality Sensors." The workshop solicited individual stakeholder views related to non-regulatory performance targets for sensors that measure fine particulate matter (PM2.5) and ozone in the U.S. Through on-site and webinar discussions, national and international participants addressed a range of technical issues involved in establishing performance targets for air sensor technologies. These issues included for example sensor performance for various measures like limits of detection and calibration, selecting approriate performance targets, and adoptiong of one set of performance targets for all non-regulatory purposes, versus a tiered approach for different sensor applications. The workshop included discussion of lessons learned from other countries about choices or trade-offs they have made or debated in establishing performance targets for measurement technologies.

As a follow up, a group of technical experts will work with EPA to document and summarize the individual perspectives communicated at the workshop, within the context of relevant scientific literature, and share the findings with wider audiences. Workshop products, to include presentations delivered to the workshop as well as a future peer reviewed journal article summarizing key workshop findings, will be released via the US EPA's Air Sensor Toolbox website: https://www.epa.gov/air-sensor-toolbox.

Partner: Colorado, District of Columbia, Mississippi, Oklahoma, Tennessee, Vermont and Wisconsin state environmental and/or public health agencies
Challenge: Enabling state and local communities to rapidly respond to ricin contamination (completed)
Resource: Technical assistance to aid field and laboratory approaches for sampling and analysis, operationally applying decontamination methods, and strategically handling wastes

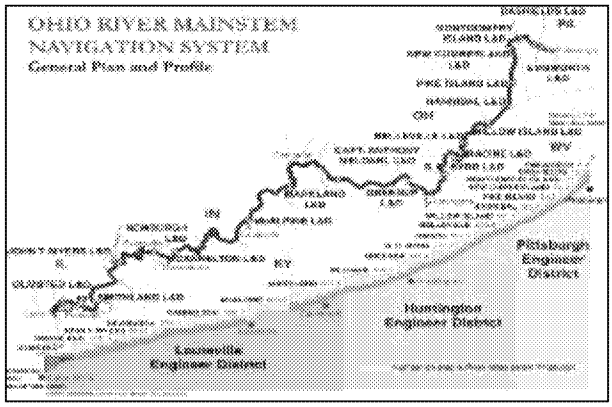
"Working with the EPA in response to this Ricin incident proved to be invaluable. They provided remediation expertise and testing resources that saved our agency significant staff time. Thanks to their support, the property was appropriately decontaminated, eliminating any potential for future concern. Further, their knowledge and availability helped to ensure that we could quickly respond to the needs of the community." – Boulder County Public Health, Water Quality and Hazardous Waste Coordinator Erin Dodge

Ricin is a deadly biological toxin that is easily produced from castor beans, making it one of the most worrisome biological threat agents. Multiple ricin incidents occurred following episodes in the popular television show "Breaking Bad" that featured its production. EPA ORD researchers and subject matter experts from the CBRNE Consequence Management Advisory Division in EPA's Office of Land and Emergency Management/Office of Emergency Management were called upon by EPA Regions 1, 3, 4, 5, 6 and 8 to support various state and local communities during independent ricin incidents spanning several years. EPA researchers developed innovative applied solutions to the challenges encountered during the first ricin responses leading to significantly shortened response times and decreased costs and resources required for the subsequent ricin incidents. The developed tools provide the federal government with important new capabilities for helping states and local communities respond to ricin incidents.

As one recent example, EPA ORD researchers rapidly supported EPA Region 8's (Mountains and Plains) response to a ricin incident at a condominium in Boulder, Colorado. The applied solutions directly informed the sampling plan, sample analysis, decontaminant selection, decontamination of responders and their equipment, and handling of the ricin waste. Because the laboratory used ORD's recently developed analysis methods, some post-decontamination samples indicated that ricin was still present in the condominium; these methods removed analytics interferences and, thereby, increased the capability to detect ricin in environmental samples. This information enabled state decision makers to determine that further decontamination of the unit was required to protect public health. Without this research, the condominium could have been declared clean and safe for re-occupancy when in fact ricin would have remained.

These efforts enabled the states and local communities to rapidly respond to ricin contamination incidents and effectively clean up the affected areas. EPA researchers helped close scientific gaps, transition scientific solutions, and enabled the states and local communities to be ready to rapidly respond to the next ricin or other biotoxin incident.

Partner: Ohio River Valley Water Sanitation Commission (ORSANCO), an interstate commission representing 8 states (Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia) and the federal government
Challenge: Providing information to water utilities that will inform operating decisions and minimize impacts on water users results from spills within U.S. waterways (ongoing)
Resource: River Spill model in collaboration with Corona Engineering and American Water



"The River Spill model has been used on several recent spills on the Ohio river and has predicted the actual times and concentrations very well. If accurate spill and river condition data is fed into the River Spill model, the model seems to accurately predict the resulting conditions downstream." – ORSANCO Technical Program Manager Sam Dinkins

There are 25,000 navigable miles of inland waterways within the contiguous U.S., which transport an estimated 630 million tons of commodities valued at $73 billion annually. There are also hundreds of drinking water intakes that supply drinking water to 66% of American water consumers. Spills within U.S. waterways can threaten safe drinking water supplies, fire protection, commerce, and critical navigation activities.

Given this challenge, EPA ORD researchers developed software that can run two-dimension models of spills in rivers. The software helps utilities decide if they should close their intake, add additional treatment, or access alternative water supplies, if available, while the worst of the spill plume passes. The River Spill model uses real time river data collected and distributed by the U.S. Geological Survey and the U.S. Army Corps of Engineers, and can be run on a computer or handheld device. The model adds two-dimension definition and real-time updates to the U.S. Department of Defense's Technical Reachback Division's IC Water model.

The River Spill model is currently being tested by ORSANCO and American Water on spills that occur on the Ohio River and its tributary system. The initial results indicate good correlation between the model and actual spill conditions. Commercial entities such as Corona Engineering and American Water, which is the largest publicly held water company in the U.S., are partnering with EPA to test the River Spill model in West Virginia. The River Spill model is also being adapted to work on other river systems within the U.S. Current ongoing applications for the model include the Tom Bigbee Water Way and the Des Moines River. The model will allow any water utility utilizing source water from a river system to make the most informed operating decisions concerning spills within minutes of data input.

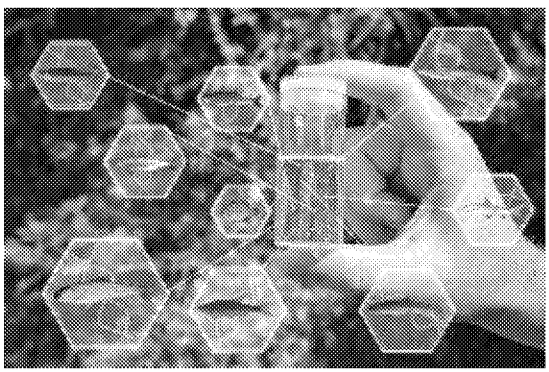
CALIFORNIA, KENTUCKY, MARYLAND, WEST VIRGINIA

Partner: Maryland Department of Natural Resources (MDDNR), West Virginia Division of Natural Resources (WVDNR), California Department of Fish and Wildlife (CADFW), California Department of Water Resources (CADWR), California State Water Reclamation Control Board (CASWRCB)

Challenge: Accurate methods to detect hard-to-find endangered species

Resource: Environmental DNA (eDNA) for inventory and monitoring of imperiled species in collaboration with the U.S. Fish and Wildlife Service (USFWS) Pennsylvania Field Office, and the University of Kentucky Department of Forestry

"The development and validation of the eDNA methodology will profoundly change how aquatic populations are monitored and significantly improve the ability to conserve and recover rare aquatic species." - Janet Clayton, Wildlife Diversity Biologist, WVDNR



Conservation and management of endangered species requires being able locate populations and determine their distribution of in the environment. However, classical monitoring approaches may overlook or underestimate species presence. Because living organisms constantly shed DNA into the environment, environmental DNA (eDNA) may offer an efficient and non-invasive solution for detecting sensitive species at low abundances and can be readily obtained from environmental samples (e.g., water, soil) instead of thru capture of whole organisms. Because each organism's DNA contains a unique genetic code, eDNA can be used for precise taxonomic identification. The non-invasive nature of eDNA surveillance reduces stress, harm, and spread of disease to the species of interest.

To provide support to various state agencies and in collaboration with EPA Region 3 (Mid-Atlantic), EPA Region 9 (Southwest), the U.S. Fish and Wildlife Service (USFWS) Pennsylvania Field Office, and the University of Kentucky Department of Forestry, ORD scientist developed eDNA tools and assessed the capability of eDNA to determine distribution and relative abundance of species of concern. This included the federally-listed dwarf wedgemussel (*Alasmidonta heterodon*) within the Chesapeake and Potomac drainage basins in Maryland. Ongoing research is targeting multiple salamander species in KY streams, several imperiled freshwater mussels (Northern riffleshell, Snuffbox, Brook and Green floaters) in WV PA, and MD; and listed species in the Sacramento river (Delta smelt) and Vernal pools (Fairy shrimp) in the Central Valley, CA.

These studies demonstrate how eDNA can be an effective tool for determining species occupancy at low abundances or limited biomass. For example, dwarf wedgemussel eDNA was detected in water samples from all Maryland streams known to support the species including streams with relatively low abundances. *Innovative techniques like eDNA surveillance can be incorporated into the species conservation management tool box as an efficient and cost-effective means for state agencies to inventory and monitor imperiled species occupancy, to guide more localized traditional monitoring efforts, and to inform habitat suitability studies for species reintroduction programs.*

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